ATTACHMENT A

DECADAL SURVEY MISSION (DSM) STUDY

STATEMENT OF WORK

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DSM Study Statement of Work

1.0 Introduction

This statement of work (SOW) specifies the tasks and deliverables required for the NASA Earth Science Decadal Survey Missions (DSM) Study.

The National Research Council (NRC) completed its first decadal survey for Earth science, Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond in January, 2007. Fifteen new missions in the next decade were identified for NASA. They are grouped into TIER I, TIER II, and TIER III missions according to their Launch Readiness Dates (LRDs). Seven of the fifteen missions (TIER I and TIER II) are the subject of this study.

The TIER I missions include CLARREO, ICESAT-II, DESDynI, and SMAP. These four missions are comprised of six spacecraft: CLARREO spacecraft 1, CLARREO spacecraft 2, ICESAT-II, DESDynI radar spacecraft, DESDynI lidar spacecraft and SMAP. The primary focus of this study is these spacecraft with the exception of the DESDynI radar spacecraft and SMAP (see Table1). The four TIER II missions are addressed only as a secondary study objective. Each of the TIER I missions incorporated in this study will launch prior to 2020.

Technical information in support of this study is available in Request for Information (RFI) for the CLARREO mission previously released to industry. This RFI is available at http://clarreo.larc.nasa.gov. ICESAT-2 Mission Objectives document also provides technical information in support of this study and can be found as Enclosure 1 to the RFP. Additionally, a reference Mission Assurance Requirements (MAR) document is included as Attachment B to the RFP and a tabular summary of mission parameters (Table 1) is included as Attachment C.

Additional information on the Decadal Missions, including individual mission statements, is available at:

http://decadal.gsfc.nasa.gov/

2.0 Work to be Performed

The study contractor shall develop a cost effective approach using a common spacecraft bus to meet the requirements of the three TIER I missions and assess the capability and flexibility of the common spacecraft to meet the requirements of the four TIER II missions.

2.1 Study Assumptions

This study shall be based on the following assumptions:

a. The contractor shall assume for purposes of these study assumptions that they are fulfilling the role of an observatory contractor. The contractor shall design, fabricate, integrate and test the spacecraft bus, integrate the instruments, perform observatory level testing, ship the observatory to the launch site, perform launch site testing, support launch site operations and launch, perform on orbit spacecraft deployment, bus checkout and support instrument activation, checkout and calibrations. The contractor shall also provide operation procedures and scripts and conduct operation training, and provide spacecraft simulator(s) and sustaining engineering support for the operation phase.

b. All instruments will be furnished by the government.

c. Communication for commands, housekeeping telemetry and science data downlink shall be via the NASA Space Network and/or Near Earth Network.

d. GPS shall be used for timing and orbit determination.

e. Command uplink shall comply with the Space Asset Protection Requirements in GPD 7120.1A.

f. Compliance with the General Environmental Verification Standard (GEVS) for GSFC Flight Programs and Projects (GSFC-STD-7000) or equivalent is required.

g. Compliance with the GSFC Rules for the Design, Development, Verification, and Operation of Flight Systems, GSFC-STD-1000 is required.

h. Providing for a controlled re-entry at the end of the mission is required.

i. Two months for on-orbit checkout and calibration of the Observatory is required.

j. The launch vehicle and services will be procured by the government. The candidates are Taurus II standard, Taurus II 3rd stage option, Delta IV M, Falcon 9, ATLAS V 401 and top spacecraft on a dual manifest ATLAS V 401 DSS with 0 plugs.

k. The mission and instrument requirements as defined in Table 1 (attached) may be updated at the beginning of the Study.

2.2 Study Tasks

The study contractor shall perform the following tasks:

• Develop a common spacecraft bus design with mission unique modifications to accommodate the instrument(s) of the three TIER I missions with adequate margins for mass, power and propellant. The goal is to have the observatory (i.e.

spacecraft bus and instrument(s)) for each of the three missions compatible with all candidate launch vehicles and fit into the following static envelope (station, diameter): 0, 3.45m; 3.22m, 3.45m; 5.13m, 2.43m; 6.57m, 0.75m.

• Given that the common spacecraft bus design concept to be developed is likely to be driven by one or more of the TIER I missions, for each of the remaining TIER I missions which do not fully consume the available capabilities and resources (mass, power, data volume/rates, etc,) of the common spacecraft bus, describe for each of those missions how much excess spacecraft bus capability could be made available to additional payload elements to be added at a later time ("Payload of Opportunity").

• Perform studies and analyses to support the design, including trade-off studies to justify the design approach.

• Identify technical, cost, schedule and other drivers, and make specific recommendations to reduce cost and/or save time, including but not limited to requirements relaxation, instrument design modifications.

• Recommend a set of common instrument interface requirements to reduce interface complexity and cost.

• Propose an optimized schedule for each spacecraft and observatory development through I&T and delivery. These schedules shall overlap in time such that the overall cost (manpower, logistics and testing) are minimized. Specifically, identification of the minimum and maximum separation of launch readiness dates to achieve the proposed savings must be identified (e.g. Satellite completion of the second unit must be required no less than [TBD] months and no more than [TBD] months after completion of the first unit. If different for subsequent units (#3, #4, etc.) please identify the difference.

• Perform a Rough Order of Magnitude (ROM) cost estimate and funding profile based on the required LRD dates, the desired instrument delivery dates and the cost distribution over the different phases of the observatory design and deployment. The ROM cost estimate shall include the cost of the first bus and the cost for each subsequent bus. The cost saving factors and associated savings shall be itemized e.g. common design team effort, group-buy of subcontracted component hardware, savings in I&T labor or facilities costs due to serialized testing at the component, subsystem or satellite level. The ROM costs for accepting the spacecraft on orbit following on-orbit check-out shall be provided, as well as the cost differential for accepting the spacecraft on ground.

• Evaluate the impacts of changing the spacecraft bus from Class B to Class C. Specifically, starting with the baseline Class B spacecraft bus (NPR 8705.4) and the attached Mission Assurance Requirements for Class B Missions, evaluate the potential impacts and cost reductions if the Class B requirements are changed to

Class C without changing mission life and consumable requirements. Itemize the cost saving factors and associated impacts and savings.

• The contractor shall identify those TIER II missions that could also be accommodated on the common spacecraft as designed and those that could be reasonably accommodated with minor modifications (e.g. a "high-power" version of this bus, or an "enhanced pointing stability" version of this bus).

• The contractor shall determine if similar cost and schedule optimizations would be realized for other acquisition means (such as the potential RSDO III contract).

• The contractor shall support a Kick-off meeting, a Mid-Term Review, a Final Review and biweekly telephone conferences.

3.0 Reporting and Deliverables

The contractor shall:

• Support throughout the execution of the study, at intervals not more frequently than every two weeks, teleconferences with the study sponsors engineering support team. These teleconferences may be scheduled to ask questions of clarification and request additional information. Any clarifications, corrections, or additional information provided subsequent to the initiation of the study contracts will be provided equally to all study participants.

•**Deliver a 3-D CAD model at the end of the study** in an industry standard format of sufficient detail to allow evaluation of spacecraft layout and the mechanical accommodation of the instruments.

• **Support a mid-term oral presentation and provide a written review package consisting of (at a minimum):**

- a summary of work completed to date with preliminary results
- summary of remaining work
- a detailed schedule
- an accounting of funds expended and remaining.

• **At the conclusion of the study, the contractor shall support a final oral presentation and provide a final written report consisting of (at a minimum)**:

- a Mission Concept of Operations for each Observatory using the common spacecraft design
- final ROM cost for the common spacecraft design reflecting the optimized schedule and including:
  - cost of the first bus and each subsequent bus
  - itemized cost savings factors
  - cost for accepting the spacecraft on orbit as compared

to accepting on the ground

- recommended MAR shall also be provided along with a final estimate of the cost of implementing the recommended MAR as opposed to implementing the referenced MAR
- an architecture supporting each mission utilizing the common spacecraft. The architectures shall consist of block diagrams and text of sufficient detail to identify all spacecraft sub-systems, payload interface, signal flow, mass, power, heritage of each component, and a Master Equipment List (MEL).
- a description of each payload accommodation on the common spacecraft to include: mission unique modifications required; performance margins; mission unique integration and test (I&T) provisions such as alignment and cleanliness; sketches of Payload integration configuration and fields of view.
- the conclusion of the "Payload of Opportunity" investigation
- the conclusion of the evaluation of the TIER II missions which could be accommodated on the common spacecraft as designed and those that would require a revision to the design.
- a determination if cost and schedule advantages similar to those offered by a common spacecraft procurement are available by other acquisition means (such as the RSDO III contract).
- an optimized schedule for developing and delivering each observatory.

The contractor shall also deliver trade study results or any other supporting information deemed appropriate for evaluating the common spacecraft design.